

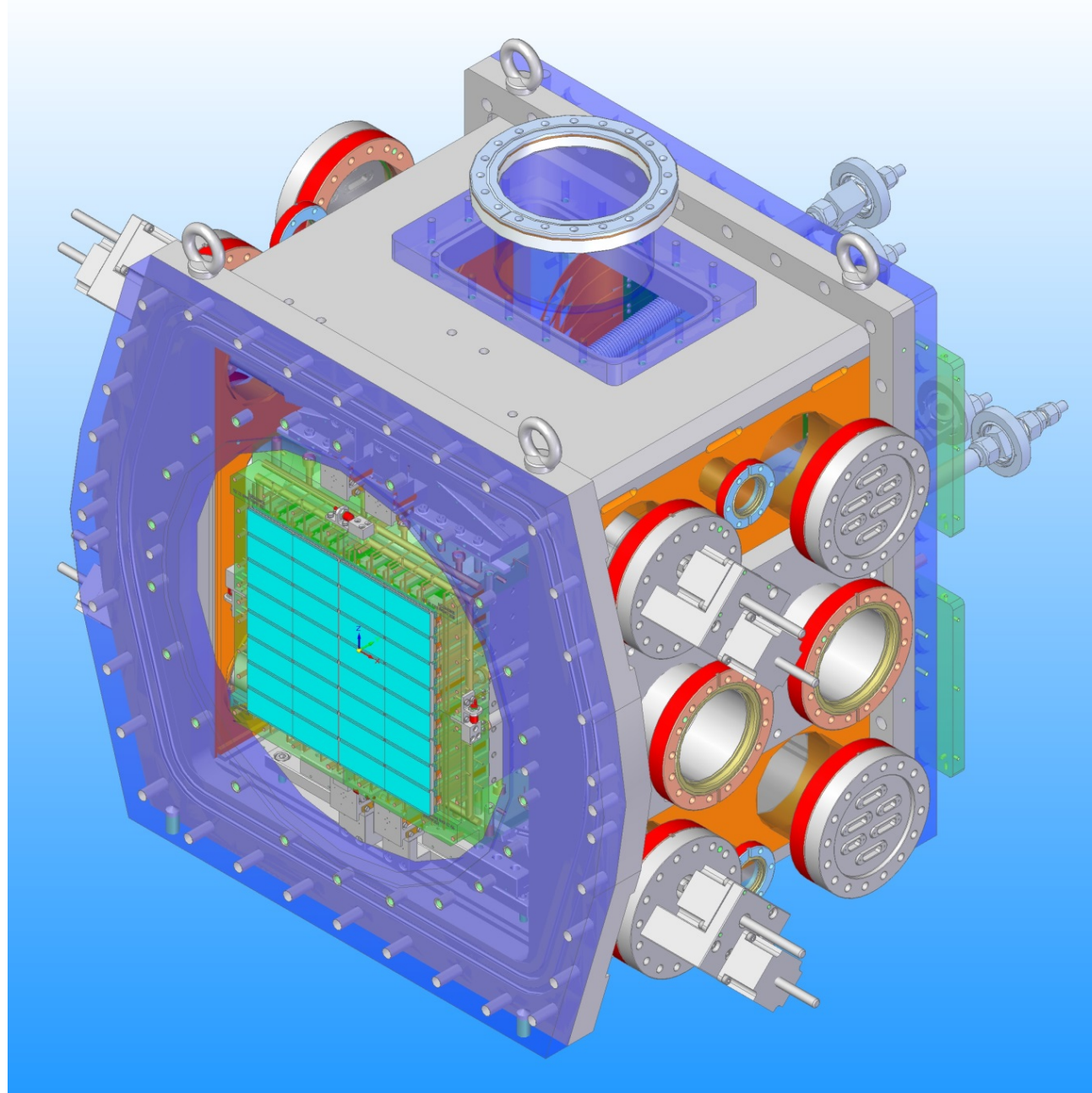
Design of double-walled bellow cooling pipes for silicone oil used for the DSSC Detector project @ European XFEL.



Frank Okrent ^{a,1}, Matthias Bayer^a, Martin Lemke^a

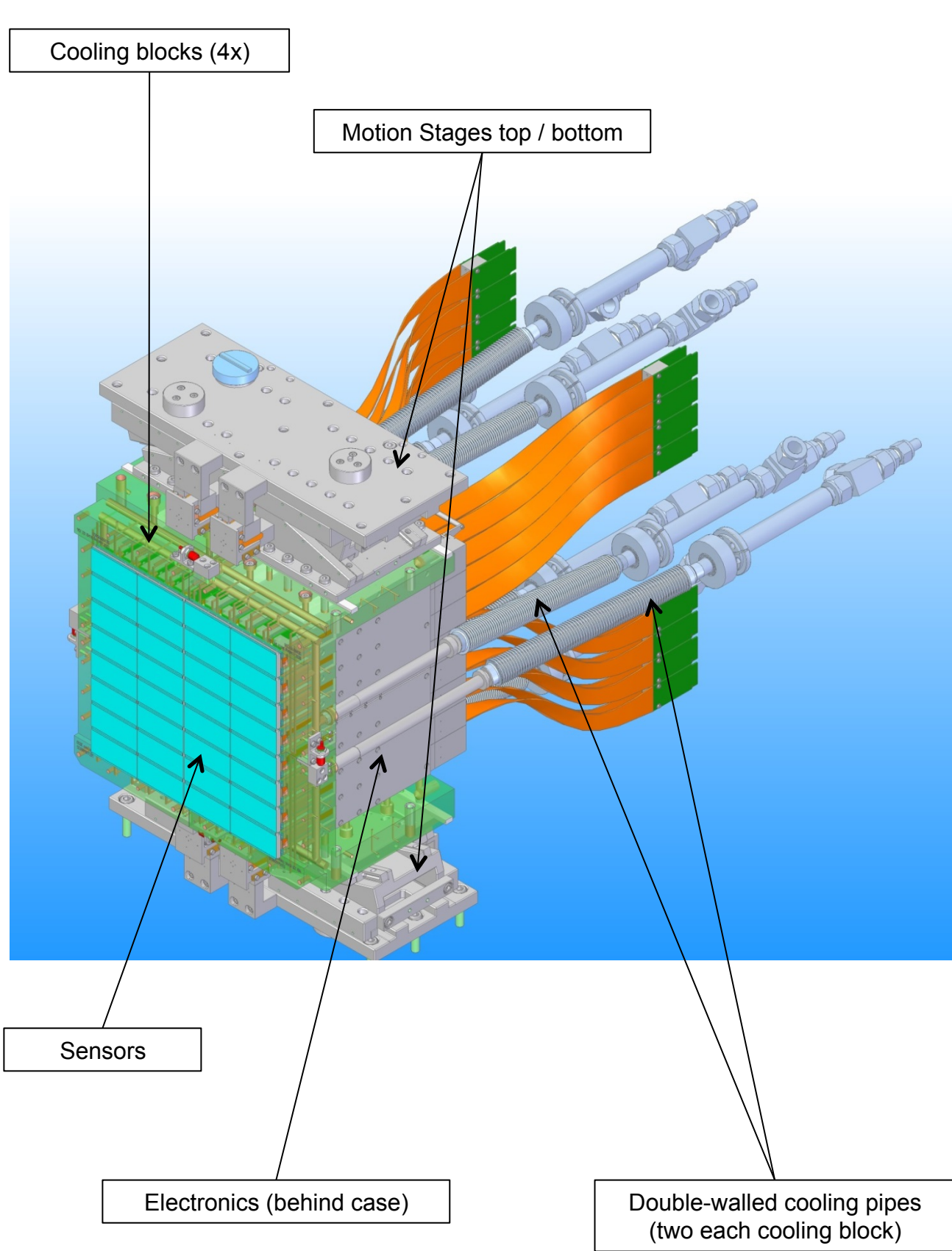
^a Center for Free Electron Laser Science (CFEL), Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany
¹ corresponding author: frank.okrent@desy.de for DESY Detector Group (FS-DS)

DSSC Detector introduction

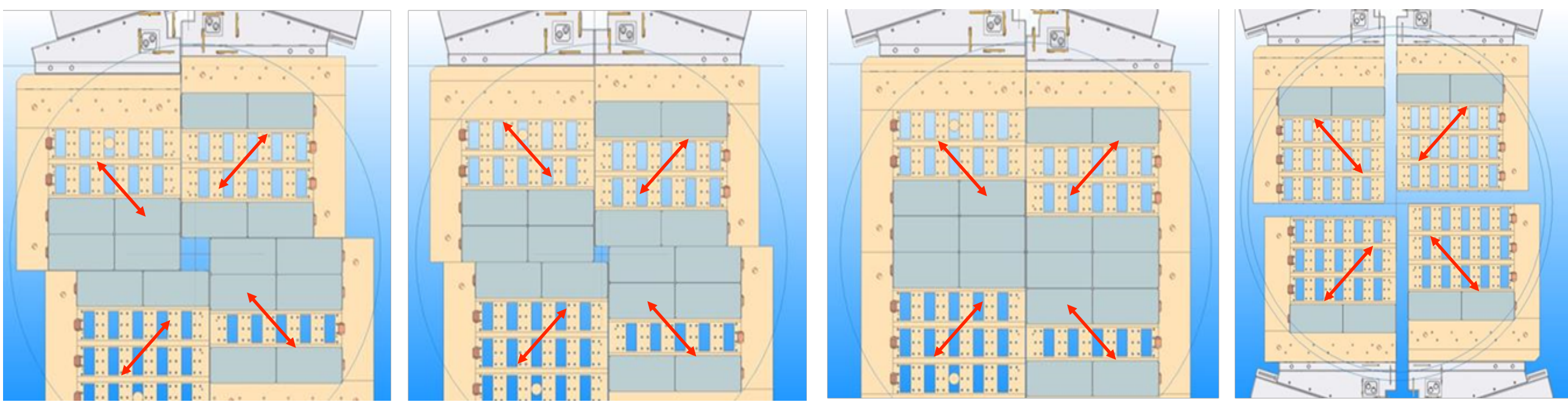


- DSSC (DEPMOS Sensor with Signal Compression)
 - non-linear gain DEPFET Sensor
 - energy range 0.5-6 keV
 - with ~40000 μm^2 hexagonal pixels
- The picture above shows the complete DSSC-Detector with vacuum vessel, Actuator- and Feedthroughflanges, Motionstages completed with cooling-block and electronics
- This is a development project for Eu-XFEL led by the MPG's Semiconductor Laboratory.

Inner parts of DSSC

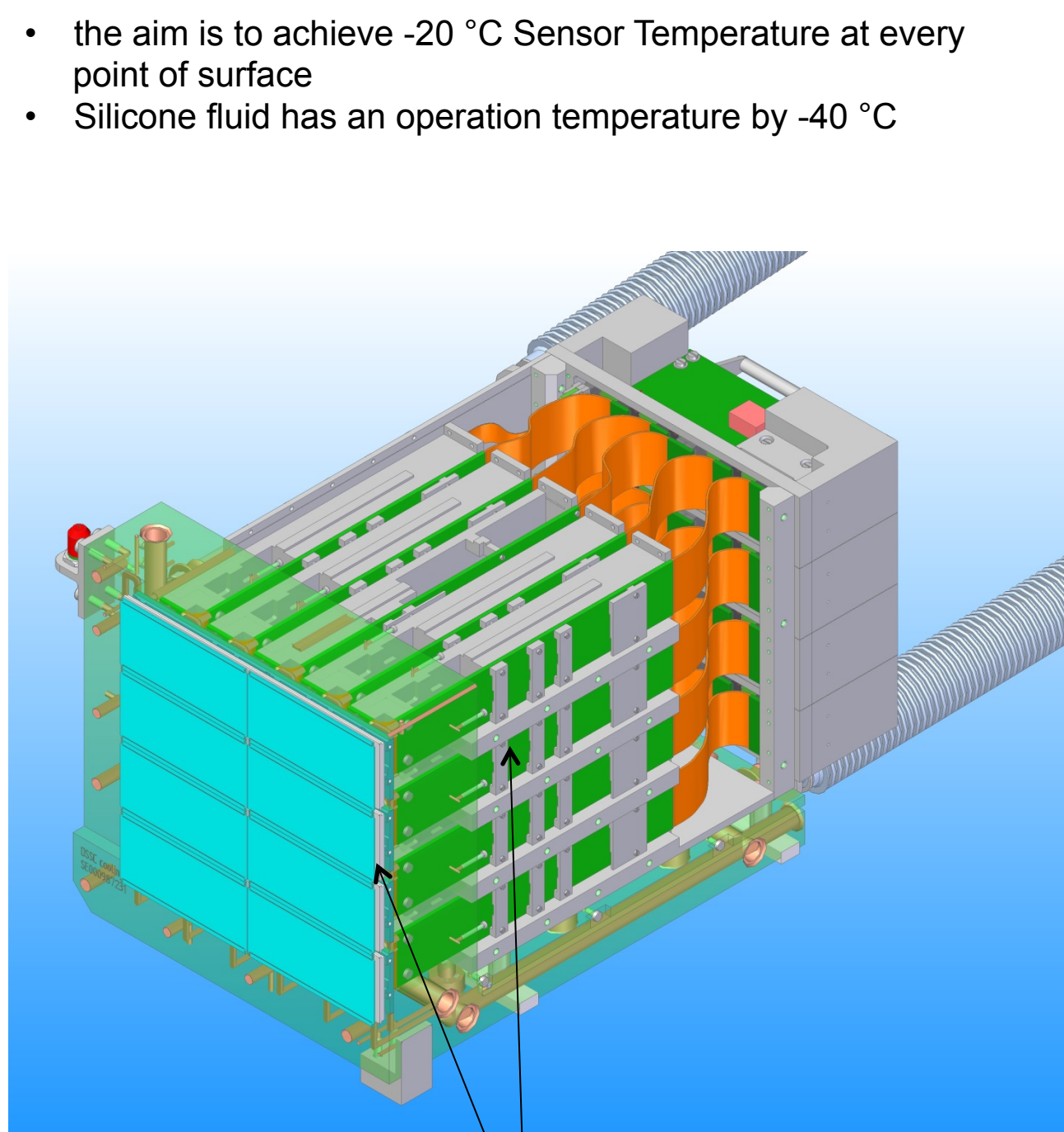


Movement of quadrants



- Quadrants moves ± 7 mm in each direction by medium-hole-position
- Cooling pipes are in fixed position at the back mainflange of the vessel
- Cooling pipes are welded to connectors in copper-blocks
- this means that the pipes itself catch this movement without bring some force into the connection points in the cooling block

Cooling-block with included electronics

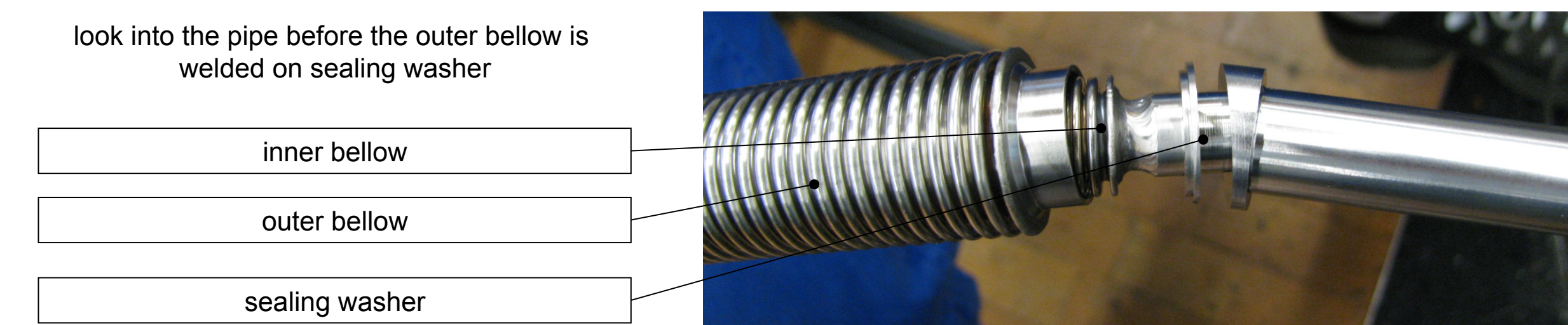
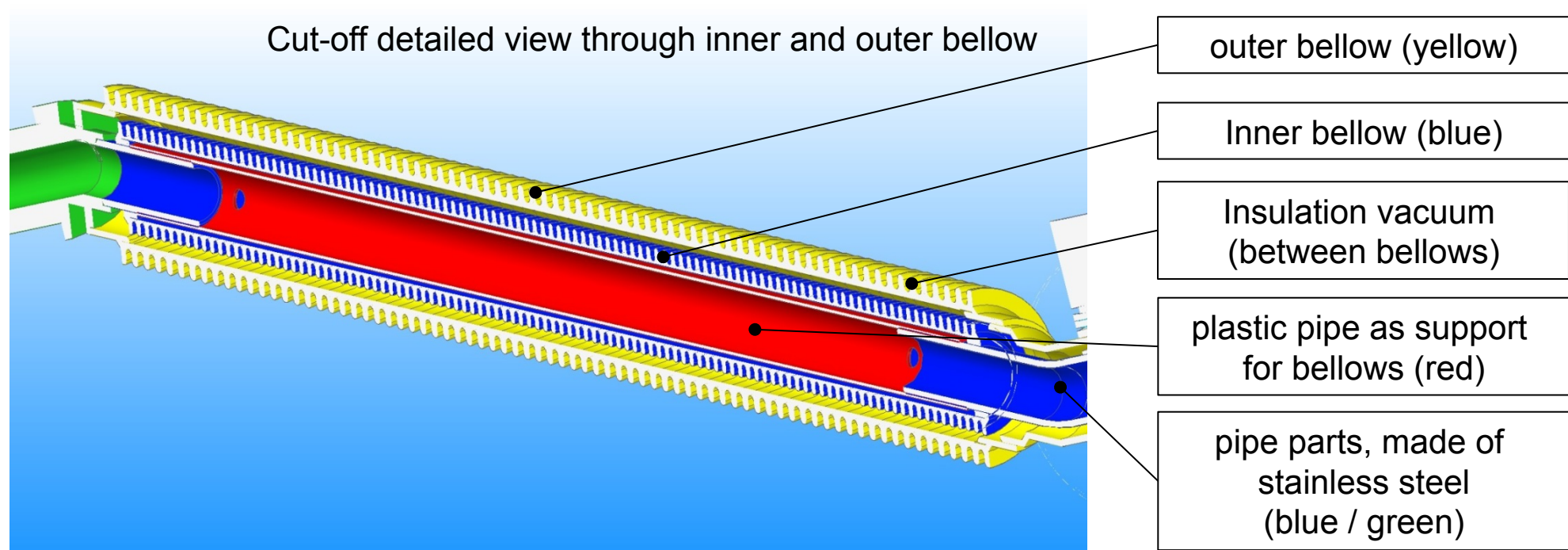
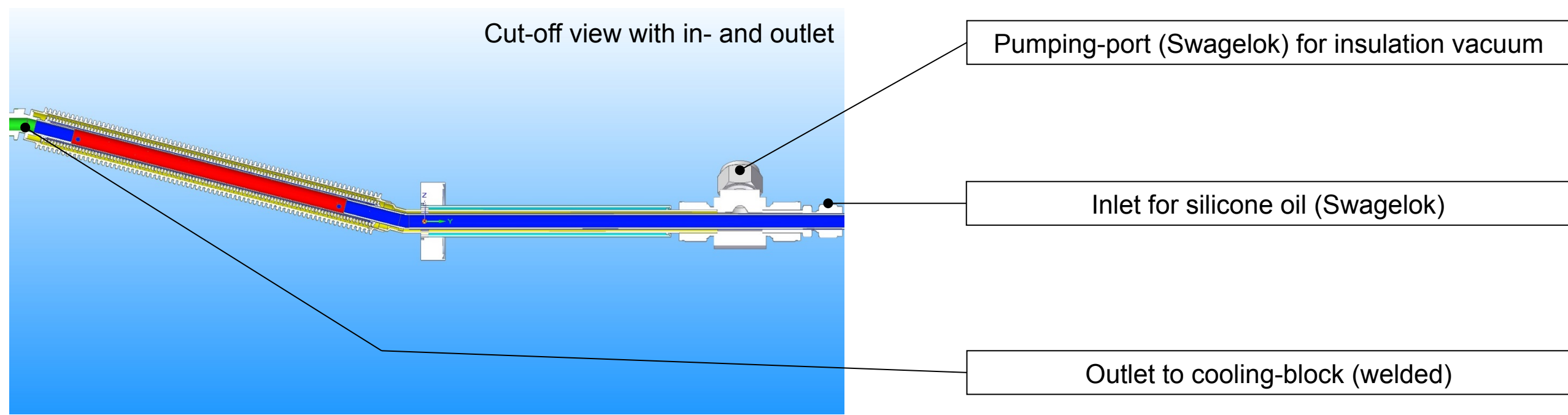


presents a challenge particularly because ~400 W are put out by the electronics in the in-vacuum detector head (by sensors and electronics boards)

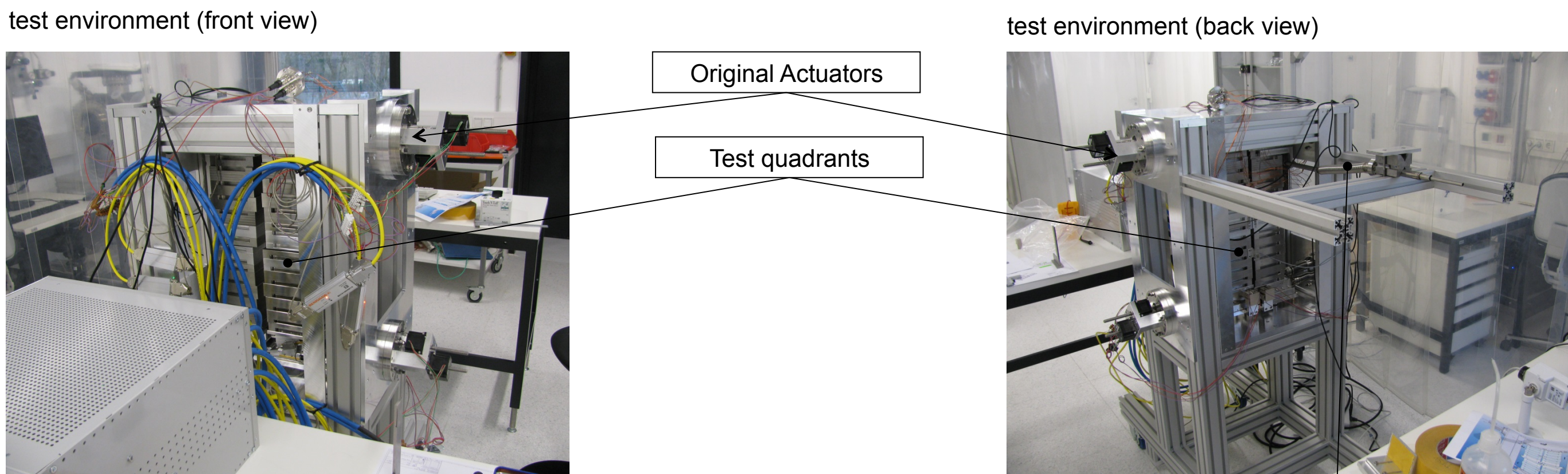
Requirements to cooling pipes

- sufficient cross-section for cooling performance, enough flow of silicone fluid
- Stainless-steel (weldable / vacuum compatible)
- liquid safe enclosed
- catch up the movement from the quadrants
- no force to connection points at the copper-blocks
- reliability about many years of user operation

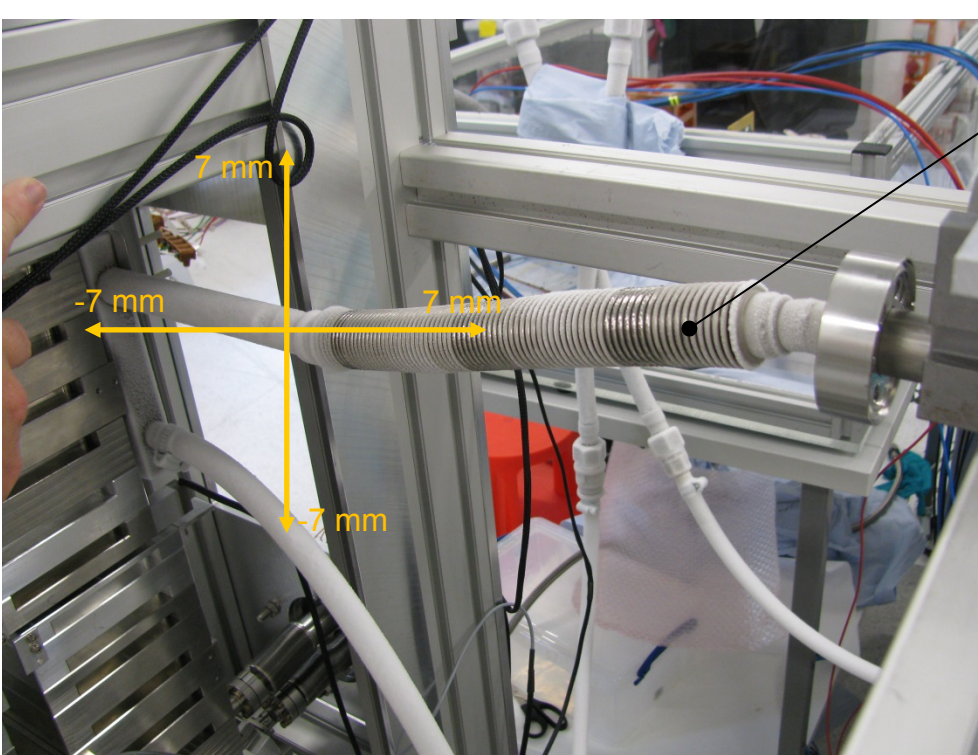
from CAD-Model to real parts



Cooling Pipe Test with moving



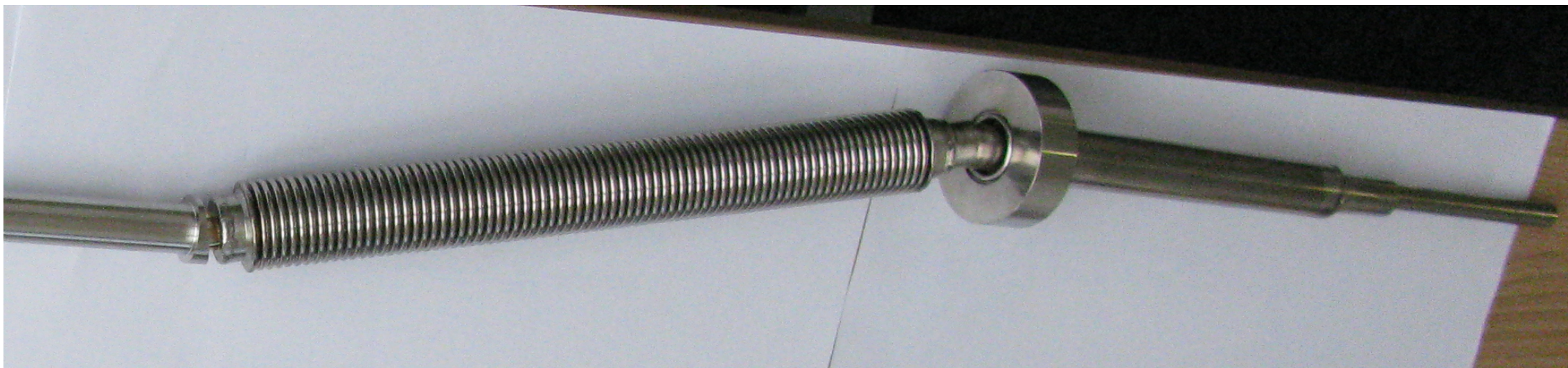
- Cooling-tube mountet at „middle size hole postion" called „zero postition"
- movement from zero is ± 7 mm in each direction
- fluid temperature -60 °C
- cycle ~19 s
- movements rotatory: circle / cross
- Duration 24 h



first cooling pipe

- welded in copper block
- fixed at AL-frame to simulate vessel

The complete double walled cooling pipe (Prototype)



Summary

- Test result is very good
- no problems with feasibility
- Cooling performance should be tested with final copper-block

We will use this part at DSSC Detector Project

Acknowledgements

- Martin Lemke, DESY ZM1, Construction Department
- Matthias Bayer, formerly DESY
- Company Witzenmann, Corrugated Bellows, www.witzenmann.de

